SMALL-SCALE COST-EFFECTIVE HOT WATER SEED TREATMENT

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Less than $200 equipment & supplies PLUS labor of course…!
We know this is difficult

- All of a sudden you’re being required to hot water treat *Brassica* seeds in Oregon
- You are very busy
- You have lots of seed lots to deal with
- You haven’t done this before & don’t have the equipment
- You are concerned about seed viability and storability
- There is some regulatory uncertainty, etc., etc.

Hot water may be a useful tool for organic farms

- Many vegetable seeds are prone to seed-borne diseases
- Without proven fungicides hot water treatment can improve our defense against diseases like blackleg, light leaf spot, *Verticillium*, *Fusarium*, *Xanthomonas*, *Alternaria*, *Botrytis* and many viruses.
Key steps

1. Maintain seed identity can be time consuming with lots of lots
2. Pre-heat seeds to avoid shock – about 100-110°F for 10 minutes
3. Treat in 122°F water with temperature accurate to 0.1-1°F
4. Cool them down right away to prevent excess heat exposure
5. Dry seed immediately to avoid priming the seed
6. Keep your system clean

<table>
<thead>
<tr>
<th>Seed</th>
<th>Water temperature</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brussels sprouts, eggplant, spinach, cabbage, tomato</td>
<td>122 °F 50 °C</td>
<td>25</td>
</tr>
<tr>
<td>Broccoli, cauliflower, carrot, collard, kale, kohlrabi, rutabaga, turnip</td>
<td>122 °F 50 °C</td>
<td>20</td>
</tr>
<tr>
<td>Mustard, cress, radish</td>
<td>122 °F 50 °C</td>
<td>15</td>
</tr>
<tr>
<td>Pepper</td>
<td>125 °F 51 °C</td>
<td>30</td>
</tr>
<tr>
<td>Lettuce, celery, celeriac</td>
<td>118 °F 47 °C</td>
<td>30</td>
</tr>
</tbody>
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From Hot Water and Chlorine Treatment of Vegetable Seeds to Eradicate Bacterial Plant Pathogens. HYG-3085-05, by Sally Miller and Melanie Lewis Ivey
1. Maintain seed identity

- Nylon stockings cut to different lengths – tight knot in one end, loose knot in the other
- Some kind of sturdy reliable clamp would be quicker
- Muslin bags or cut up pillow cases
- Label = doubled over blue masking tape w/ a Sharpy pen, plastic label with ball-point pen on the draw string…
- Water proof Sharpy’s will stay on plastic plant tags
1. Maintain seed identity – more bags

1 gallon paint strainers with rubber bands to tie the top

Stapled coffee filters
From: http://vegetablemdonline.ppath.cornell.edu/NewsArticles/HotWaterSeedTreatment.html
Pour seed & label into bags

Loosely tie the top of the bag

Make sure seed is loose in the bag – good water flow is key
2. Preheat the seeds

1. About 100-110°F for 10 minutes
2. Check temperature with a thermometer
3. Precision isn’t critical – easy enough with warm tap water
4. This could be a big area of re-infection if not cleaned – it’s a dirty step
3. Hot water step

- Accuracy ensures seed-borne pathogens are killed and seed is still viable and stores well.
- Good thermometers ~$50
  - Mercury
  - Water proof digital – Thomas Scientific two probe waterproof. Updates 2x per second with 0.1°F accuracy
- Redundancy is good - >1 thermometer
3. Hot water step

- Use a relatively large container. Lots of water maintains more even temperature during the 15-30 minutes when seeds are treated.
- Frank uses camping coolers Tom uses stainless sinks
- Circulate water with a stirring rod or $20 fishtank circulator
3. Hot water step

- Set your hot water heater to about 125°F (the water cools off a bit in the lines)
- Fill your container with the hot water
- Monitor the temperature and maintain within about 0.5-1°F if you’re planting right away. We think 0.1°F accuracy is important if you plan to store seed.
- When water starts to cool add a squirt of boiling water from the kettle
- Avoid seed contact, and circulate quickly
- Sous Vide hot water heater and circulator costs ≥$200 but is nice – used for cooking.
3. Hot water step

- Tom can run about 20lbs of seed per batch through the sinks
- Frank uses a larger cooler to run larger batches
- Only seeds with same time and temperature requirements in the same batch
- Set an alarm so you can do other things, but check the temperature at least a few times during the process unless you have confidence in your Sous Vide.
3. Hot water step

- Sometimes you can find used “circulating hot water baths” online.
- This bath was for sale on eBay for $99 and is the type often used in labs. It could work for small seed lots.
4. Cool the seed

• Cool tap water
• Get the seed down to ambient temperature right away

5. Pre-dry the seed

• Frank pre-dries small lots in the bags on a terry cloth towel
• He pours out larger lots (i.e. >1 lb) on the towel to pre-dry them more quickly
• Tom uses a spin dryer with no heat (1,600rpm for 3 minutes)
5. Dry the seed

- Air dry the seed at 85°F overnight especially if you are storing the seed
- Small lots (i.e. a few ounces) can stay in the bags
- Larger lots should be spread thinly on a screen
- Some counter-top food dryers can be set as low as 85°F
- You may be able to dry seeds on trays in a warm room or over a heating vent
- During warmer weather, gentle air flow may be sufficient
6. Clean your set-up

- Avoid re-infection from infected lots and less than 100% effective treatment
- Frank and Tom scrub everything down and replace the water between lots
- Tom is considering an ozone treatment to keep the water sterile. Then they would only have to replace the water when it has too much debris
Start small

- Try treating some extra seed at a small scale
- Test germination of treated and untreated seed from the same batch
- Consider storing some seed and testing later to gain confidence in the accuracy of your system for future years
- Start small again whenever you try a new type of seed
- Hot water treatment exacerbates problems with poor quality seed, i.e. old, harvested immature, damaged seed coat, diseased, etc.. Not always a bad thing – maybe that wouldn’t have been a profitable plant anyway.
THANKS FRANK & TOM!!!

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